Integrative Science, Technology, Engineering, and Mathematics

Robotics and Engineering Design Curriculum

The Robotics and Engineering Design Integrative STEM 8th grade Curriculum

The Robotics and Engineering Design Course (REDC) provides students with engineering design experiences to develop systems thinking abilities while integrating mathematics and science concepts that support the decisions made in the design process. The goal of the course is for students to work through a design process and solve an authentic problem, applying mathematics and science skills that they should already have learned or are currently being taught. With background knowledge and appropriate research, students are expected to be able to design and manufacture a prototype based on data collected during scaffolded investigations.

Unit Descriptions

The REDC is structured into four independent 9-week units, each of which can be taught as a self-standing Engineering and Technology exploratory elective. The units are 1) Biomechanics, 2) Electromagnetic Radiation (EMR), 3) Renewable Energy and 4) Analog to Digital Conversion. In each unit, students take the role of employees of an engineering company, responding to a "Request For Proposal "(RFP) by using LEGO® MINDSTORMS NXT robotics and 3-D prototyping to solve the relevant engineering challenge.

It is suggested that the instruction of the units are done as follows:

Biomechanics first 9weeks – Teacher and student introductory unit

EMR second 9 weeks – EMR should be coinciding with or after the instruction of the EMR spectrum.

Energy third 9weeks –Ideally taught after the instructor has gained comfort ability and confidence with Biomechanics and EMR.

Analog to Digit fourth 9weeks. The most advance unit in REDC. Relies heavily on instructor content knowledge of circuits and electricity.

Materials needed for each unit of the REDC

- 3-D Printer with a resolution between .010 to .1mm
- At lest 10 Laptops with LEGO® MINDSTORMS NXT robotics Programming/Data-Logging and 3-D Graphical Software.
- 1 LEGO® MINDSTORMS NXT robotics kit with added light and infrared sensor
- 1 Engineering Notebook for each student.
- See each investigation for other materials needed.

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Investigation 1		**Essential Question**	How can the engineering design process be used to develop a functional system in response to an RFP?	
	CTAE	**GPS Standard**	MSENGR-TS-2: The students will develop an understanding of how the design process is used to develop a technological system.	
	Science Correlations	**Practices**	Introductory week with a preview of all 8 practices.	
		Crosscutting Concepts	2. Cause and effect: Mechanism and explanation.	3. Scale, proportion, and quantity.
		Core Idea	ETS1.A. Defining and Delimiting and Engineering Problem.	
		GPS Characteristics of Science	S8CS1. Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.	S8CS2. Students will use standard safety practices for all classroom laboratory and field investigations
				S8CS4. Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities utilizing safe laboratory procedures.
		GPS Content Standards	S8P1. Students will examine the scientific view of the nature of matter.	c. Describe the movement of particles in solids, liquids, gases, and plasmas.
	Math Correlations	**CCGPS**	MCC8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	
		Standards of Mathematical Practices	1 Make sense of problems and persevere in solving them	
			2 Reason abstractly and quantitatively.	
			4 Model with mathematics.	

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			Activities	Outcomes/Products
Investigation 1		0.1	Introduction of the balloon project and explanation of the RFP. Exploring the system. Try all 3 inflators.	Observations recorded in journal.
		0.2	Discussion of the criteria and constraints of the RFP. Draft procedure for the assigned inflator type.	Journal response to prompt. Draft of procedure.
		0.3	Revisions of the procedure following testing. Discussion about and development of an hypothesis. Testing the experimental design.	Correctly written hypothesis. Observations of testing. Final
		0.4	Conduct experimental trials and record data.	Results recorded on data sheet. Plotting data onto the graph
		0.5	Compare results between groups with the same inflator type. Class-wide meeting to determine selection.	Response to wrtiting prompt. Completed Letter of Response.

Engineering & Technology Standard	Science Correlations						Math Correlations			iste-nets				English Language Arts Correlations		
	Practices		Crosscutting Concepts		Core Ideas		Common Core	Practices		Student		Teacher		Reading	Writing	Speaking & Listening
MSENGR-TS-2	1	5	1	5	ETS1.A		MCC8.F.5	1	5	1	5	1	5	RST.8.3	WHST.8.1	SL.8.1
	2	6	2	6				2	6	2	6	2		RST.8.4	WHST.8.4	SL.8.4
	3	7	3	7				3	7	3		3		RST.8.7	WHST.8.10	
	4	8	4	8				4	8	4		4		RST.8.8		

Characteristics of Science			GPS Content Standards	
1	5	9	S8P1.C	
2	6	10		
3	7			
4	8			

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Investigation 2		**Essential Question**	What is locomotion? How do systems interact to allow locomotion?	
	CTAE	**GPS Standard**	MSENGR-TS-1: The students will develop an understanding of the Universal Systems Model.	
	Science Correlations	**Practices**	2. Developing and using models	4. Analyzing and interpreting data
			3. Planning and carrying out investigations	5. Using mathematics and computational thinking
		Crosscutting Concepts	1. Patterns	4. Systems and system models
			2. Cause and effect: Mechanism and explanation	6. Structure and function
			3. Scale, proportion, and quantity	
		Core Ideas	PS2.A: Forces and Motion	ETS1.A.: Defining and Delimiting and Engineering Problem.
		GPS Characteristics of Science	S8CS3. Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations	S8CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.
			S8CS4. Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities utilizing safe laboratory procedures.	S8CS6. Students will communicate scientific ideas and activities clearly.
		GPS Content Standards	S8P3. Students will investigate the relationship between force, mass, and the motion of objects.	a. Determine the relationship between velocity and acceleration.
				c. Demonstrate the effect of simple machines on work.
	Math Correlations	**CCGPS**	MCC8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	
			MCC8.F.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	
		Standards of Mathematical Practices	2 Reason abstractly and quantitatively.	
			3 Construct viable arguments and critique the reasoning of others.	

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			Movement and Gait Activities	Outcomes/Products
Investigation 2		0.1	Present RFP: Redesign an existing mechanism (robot) for stability and efficiency traverse varied terrains. Discuss various locomotion strategies using legs. Develop a list with multiple examples of strategies.	Journal entry-strategy list.
		0.2	Exploring locomotion with models. Introduce the 3 different NXT Insectobots. Have the groups examine each and record any differences. Assign one bot for testing. Explore the bot with the tether.	Journal entry-difference table.
	2x	0.3	Groups use each of the robots and run trials. Graph each trial on the roll graph paper using the marker attachment. Timekeeper for each group should time stamp graphs. Each bot is represented by a different color all on same graph.	Graph data with time stamp.
		0.4	Use graph data to calculate average velocity for the five trials of each design. Prepare a brief presentation for the class on the relative performance of each bot. Record averages in journal.	Journal entry-averages.
		0.5	Groups present findings and graphs. Class discussion comparing the performance. Is there a clear winner?	Presentations.
		0.6	Show CRAB Lab video. Discuss the term gait. Was one robot exhibiting an ideal gait based on the video. What might explain any variations? Correct all robots so that they all have legs in the ideal configuration.	Discussion.

Engineering & Technology Standard	Science Correlations						Math Correlations			iste-nets				English Language Arts Correlations		
	Practices		Crosscutting Concepts		Core Ideas		Common Core	Practices		Student		Teacher		Reading	Writing	Speaking & Listening
MSENGR-TS-1	1	5	1	5	PS2.A	ETS1.A	MCC8.F.1	1	5	1	5	1	5	RST.8.3	WHST.8.1	SL.8.1
	2	6	2	6			MCC8.F.2	2	6	2	6	2		RST.8.4	WHST.8.2	SL.8.4
	3	7	3	7				3	7	3		3		RST.8.7	WHST.8.10	
	4	8	4	8				4	8	4		4				

Characteristics of Science			GPS Content Standards	
1	5	9	S8P3.a	
2	6	10	S8P3.c	
3	7			
4	8			

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Investigation 3		**Essential Question**	How do forces interact within the system? Where is the energy flow?	
	CTAE	**GPS Standard**	MSENGR-TS-3: The students will develop an understanding of how humans interact with systems.	
	Science Correlations	**Practices**	1. Defining problems (for engineering)	
			2. Developing and using models	
			3. Planning and carrying out investigations	
			6. Designing solutions.	
		Crosscutting Concepts	1. Patterns	5. Energy and matter: Flows, cycles, and conservation
			2. Developing and using models	6. Structure and function
			4. Systems and system models	7. Stability and change
		Core Ideas	PS2.A.: Forces and Motion	PS3.A.: Definitions of Energy
			PS2.B.: Types of Interactions	PS3.C.: Relationship Between Energy and Forces.
			ETS1.A.: Defining and Delimiting and Engineering Problem.	ETS1.B.: Developing Possible Solutions.
		GPS Characteristics of Science	S8CS3. Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations	S8CS7. Students will question scientific claims and arguments effectively.
			S8CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.	S8CS10. Students will enhance reading in all curriculum areas by: c.Building vocabulary knowledge.
		GPS Content Standards	S8P3. Students will investigate the relationship between force, mass, and the motion of objects.	a. Determine the relationship between velocity and acceleration.
				b. Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction.
	Math Correlations	**CCGPS**	MCC8.F.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)	
		Standards of Mathematical Practices	3. Construct viable arguments and critique the reasoning of others.	

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			Motion and Surfaces Activities	Outcomes/Products
Investigation 3		0.1	Foot-based locomotion; what is occuring? Students summarize experience with the three insectbots. How are these bots propelled forward? What is the motion of the legs called? Draw a diagram of the ideal gait.	Journal entry. Solid explanations. Clear illustrations.
		0.2	Traction. Students explore the amount of grip generated between their foot and three distinct surfaces.	Data table recording interactions with surfaces.
		0.3	Initial exploration of force vectors and diagrams. Basics. What is happening with your foot? Using data from previous activity to draw diagrams. How do these diagrams represent slippage?	Correctly drawn diagrams.
	2x	0.4	Run the insectbot across each of the three surfaces. Measure elapsed time to traverse 3 feet (5 trials at 80% power.) Prepare a briefing for the class.	Data table.
		0.5	Class discussion following group briefings. Did the performance vary to any great degree? Why might this be the case? Sketch force diagrams for each surface.	Three force diagrams.
		0.6	Discuss diagrams using student examples. Is energy being transferred or lost at the interface between foot and surface? How might this be measured?	Journal summary.

Engineering & Technology Standard	Science Correlations						Math Correlations			iste-nets				English Language Arts Correlations		
	Practices		Crosscutting Concepts		Core Ideas		Common Core	Practices		Student		Teacher		Reading	Writing	Speaking & Listening
MSENGR-TS-3	1	5	1	5	PS2.A	ETS1.A	MCC8.EE.7	1	5	1	5	1	5	RST.8.3	WHST.8.1	SL.8.1
	2	6	2	6	PS2.B	ETS1.B	MCC8.F.2	2	6	2	6	2		RST.8.7	WHST.8.2	SL.8.4
	3	7	3	7	PS3.A			3	7	3		3			WHST.8.4	
	4	8	4	8	PS3.C			4	8	4		4			WHST.8.10	

Characteristics of Science			GPS Content Standards	
1	5	9	S8P3.a	
2	6	10	S8P3.b	
3	7			
4	8			

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Investigation 4		**Essential Question**	Can system interactions be explained using biological analogs?	
	CTAE	**GPS Standard**	MSENGR-TS-4: The students will develop an understanding of how systems evolve from one stage to another.	
	Science Correlations	**Practices**	2. Developing and using models	8. Obtaining, evaluating, and communicating information
			3. Planning and carrying out investigations	
		Crosscutting Concepts	1. Patterns	5. Energy and matter: Flows, cycles, and conservation
			2. Developing and using models	6. Structure and function
		Core Ideas	PS2.A.: Forces and Motion	PS2.B.: Types of Interactions
			PS2.C.: Stability and Instability in Physical Systems.	
		GPS Characteristics of Science	S8CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.	S8CS8. Students will be familiar with the characteristics of scientific knowledge and how it is achieved.
			S8CS6. Students will communicate scientific ideas and activities clearly.	S8CS9. Students will understand the features of the process of scientific inquiry.
		GPS Content Standards	S8P3. Students will investigate the relationship between force, mass, and the motion of objects.	b. Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction.
	Math Correlations	**CCGPS**	MCC8.EE.7 Solve linear equations in one variable.	
			MCC8.F.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)	
		Standards of Mathematical Practices	3. Construct viable arguments and critique the reasoning of others.	

			Data Logging Activities	Outcomes/Products
Investigation 4		0.1	Introduce NXT Data Logging. Using same robots (wheels installed as outlined.) Demonstrate basics of data acquisition both live and remote. MEMORY MANAGEMENT! Discuss demo graphs including slope relevance.	Notes in journal. Annotated handout.
		0.2	Remind students about memory! Remote data collection. Try several runs using wheeled bots. Once confident, reinstall legs in proper configuration. Introduce the second power level (50%.) Discuss potential diffences between 50 and 80%.	Record predictions in journal.
	2x	0.3	Run multiple trials (5 successful) with each power level. Save a screen shot (demonstrate how to do this) of each graph for later analysis. Select the graph that best represents the average performance for each power level.	Graph analysis worksheet.
		0.4	Calculate the slope for each power level using the selected graphs. Calculate the average velocity for each power level from the same graphs. Does the slope result match the calculated average? What might be happening?	Calculations in journal.
		0.5	Is there evidence of slippage? If so, what conditions might be responsible? Sketch a force diagram for a foot for each power level.	Force diagrams.
		0.6	Class discussion of results. Relate to previous activities. Does data-logging make it easier to see trends?	Discussion.

Engineering & Technology Standard	Science Correlations						Math Correlations			iste-nets				English Language Arts Correlations		
	Practices		Crosscutting Concepts		Core Ideas		Common Core	Practices		Student		Teacher		Reading	Writing	Speaking & Listening
MSENGR-TS-4	1	5	1	5	PS2.A		MCC8.EE.7	1	5	1	5	1	5	RST.8.3	WHST.8.1	SL.8.1
	2	6	2	6	PS2.B		MCC8.F.2	2	6	2	6	2		RST.8.7	WHST.8.10	SL.8.4
	3	7	3	7	PS2.C			3	7	3		3				
	4	8	4	8				4	8	4		4				

Characteristics of Science			GPS Content Standards	
1	5	9	S8P3.b.	
2	6	10		
3	7			
4	8			

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Investigation 5		**Essential Question**	How is a complex system affected by the modification of a single variable within one subsystem?	
	CTAE	**GPS Standard**	MSENGR-TS-5: The students will recognize and be able to forecast trends in the development of technological systems.	
	Science Correlations	**Practices**	1. Defining problems (for engineering)	4. Analyzing and interpreting data
			2. Developing and using models	6. Designing solutions.
			3. Planning and carrying out investigations	
		Crosscutting Concepts	2. Developing and using models	5. Energy and matter: Flows, cycles, and conservation
			4. Systems and system models	7. Stability and change
		Core Ideas	PS2.A.: Forces and Motion	PS3.C.: Relationship Between Energy and Forces.
			PS2.C.: Stability and Instability in Physical Systems.	ETS1.A.: Defining and Delimiting and Engineering Problem.
			PS2.B.: Types of Interactions	ETS1.B.: Developing Possible Solutions.
			PS3.A.: Definitions of Energy	ETS1.C.: Optimizing the Design Solution
		GPS Characteristics of Science	S8CS4. Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities utilizing safe laboratory procedures.	S8CS5. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.
				S8CS9. Students will understand the features of the process of scientific inquiry.
		GPS Content Standards	S8P2. Students will be familiar with the forms and transformations of energy.	b. Explain the relationship between potential and kinetic energy.
			S8P3. Students will investigate the relationship between force, mass, and the motion of objects.	b. Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction.
	Math Correlations	**CCGPS**	MCC8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph(e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	
			MCC8.SP.1 Construct and interpret scatter plots for varying measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	
		Standards of Mathematical Practices	1. Make sense of problems and persevere in solving them.	5. Use appropriate tools strategically.
			2. Reason abstractly and quantitatively.	7. Look for and make use of structure.

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			Activities	Outcomes/Products
Investigation 5		0.1	Reintroduce the RFP. Class discussion about surfaces and feet. What might an optimum foot look like? Introduce a new surface (FRP pebble sheet.) Outline team requirements for response to the RFP.	Team organization chart.
		0.2	Introduction to SolidWorks. Use large scale models to demonstrate simple modeling processes such as an extruded cut and an extrusion. Guided student practice on sample part. Student demos on projector. Develop several potential foot design sketches.	Sketches in journal.
		0.3	Throughout testing record 5 trials per change. All trials logged with the NXT software. Design changes should consider: physical constraints, force interaction, energy transfer due to friction, optimal stability of the robot, and transfer of energy.	Develop a data collection format for the journal.

Engineering & Technology Standards	Science Correlations						Math Correlations			iste-nets				English Language Arts Correlations		
	Practices		Crosscutting Concepts		Core Ideas		Common Core	Practices		Student		Teacher		Reading	Writing	Speaking & Listening
MSENGR-TS-5	1	5	1	5	PS2.A	PS3.C	MCC8.F.5	1	5	1	5	1	5	RST.8.3	WHST.8.1	SL.8.1
MSENGR-TS-6	2	6	2	6	PS2.B	ETS1.A	MCC8.SP.1	2	6	2	6	2	6	RST.8.4	WHST.8.2	SL.8.4
	3	7	3	7	PS2.C	ETS1.B		3	7	3	7	3	7	RST.8.7	WHST.8.4	
	4	8	4	8	PS3.A	ETS1.C		4	8	4	8	4	8		WHST.8.10	

Characteristics of Science			GPS Content Standards	
1	5	9	S8P2.b.	
2	6	10	S8P3.b.	
3	7			
4	8			

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Investigation 6		**Essential Question**	How has your system evolved through iteration? How can technology facilitate the design process?	
	CTAE	**GPS Standard**	MSENGR-TS-7: Students will develop leadership skills and work ethics.	
	Science Correlations	**Practices**	1. Defining problems (for engineering)	5. Using mathematics and computational thinking
			2. Developing and using models	6. Designing solutions.
			3. Planning and carrying out investigations	7. Engaging in argument from evidence
			4. Analyzing and interpreting data	8. Obtaining, evaluating, and communicating information
		Crosscutting Concepts	2. Developing and using models	6. Structure and function
			4. Systems and system models	7. Stability and change
			5. Energy and matter: Flows, cycles, and conservation	
		Core Ideas	PS2.A.: Forces and Motion	PS3.C.: Relationship Between Energy and Forces.
			PS2.B.: Types of Interactions	ETS1.A.: Defining and Delimiting and Engineering Problem.
			PS2.C.: Stability and Instability in Physical Systems.	ETS1.B.: Developing Possible Solutions.
			PS3.B.: Conservation of Energy and Energy Transfer	ETS1.C.: Optimizing the Design Solution
		GPS Characteristics of Science	S8CS5	S8CS7
			S8CS6	S8CS9
		GPS Content Standards	S8P2. Students will be familiar with the forms and transformations of energy.	b. Explain the relationship between potential and kinetic energy.
			S8P3. Students will investigate the relationship between force, mass, and the motion of objects.	Sub strands a, b, and c.
	Math Correlations	**CCGPS**	MCC8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	
		Standards of Mathematical Practices	1 Make sense of problems and persevere in solving them.	6. Designing solutions.
			2. Reason abstractly and quantitatively. 4. Analyzing and interpreting data	8 Look for and express regularity in repeated reasoning.

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			Activities	Outcomes/Products
Investigation 6		0.1 - 0.8	Select roles within each design team. Second part iteration due day 4, investigation 6. Review criteria and constraints. Throughout testing recall 5 trials per change. Design changes should consider: physical constraints, force interaction, energy transfer due to friction, optimal stability of the robot, and transfer of energy. Preparation of a design brief. Third part iteration due day 1, investigation 7.	SolidWorks designs supported by thinking in journal entries. Data properly recorded and analysis done. Rational explanations explain design changes. Design brief draft. First and second foot designs.

Engineering & Technology Standard	Science Correlations						Math Correlations			iste-nets				English Language Arts Correlations		
	Practices		Crosscutting Concepts		Core Ideas		Common Core	Practices		Student		Teacher		Reading	Writing	Speaking & Listening
MSENGR-TS-7	1	5	1	5	PS2.A	PS3.C	MCC8.SP.1	1	5	1	5	1	5	RST.8.4	WHST.8.1	SL.8.1
	2	6	2	6	PS2.B	ETS1.A		2	6	2	6	2		RST.8.7	WHST.8.2	SL.8.4
	3	7	3	7	PS2.C	ETS1.B		3	7	3		3		RST.8.8	WHST.8.4	
	4	8	4	8	PS3.B	ETS1.C		4	8	4		4				

Characteristics of Science			GPS Content Standards	
1	5	9	S8P2.b.	
2	6	10	S8P3.a.	
3	7		S8P3.b.	
4	8		S8P3.c.	

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Investigation 7		**Essential Question**	What are the challenges involved in manufacturing a new component of a system?	
	CTAE	**GPS Standard**	MSENGR-TS-6: The students will recognize relationships among technologies and assess the impact of technological systems.	
	Science Correlations	**Practices**	2. Developing and using models	8. Obtaining, evaluating, and communicating information
			4. Analyzing and interpreting data	
		Crosscutting Concepts	5. Energy and matter: Flows, cycles, and conservation	7. Stability and change
			6. Structure and function	
		Core Ideas	PS2.A.: Forces and Motion	PS3.C.: Relationship Between Energy and Forces.
			PS2.B.: Types of Interactions	ETS1.B.: Developing Possible Solutions.
			PS2.C.: Stability and Instability in Physical Systems.	ETS1.C.: Optimizing the Design Solution
			PS3.B.: Conservation of Energy and Energy Transfer	
		GPS Characteristics of Science	S8CS5	S8CS8
			S8CS6	S8CS9
		GPS Content Standards	S8P2. Students will be familiar with the forms and transformations of energy.	b. Explain the relationship between potential and kinetic energy.
			S8P3. Students will investigate the relationship between force, mass, and the motion of objects.	Sub strands b and c.
	Math Correlations	**CCGPS**	MCC8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	
		Standards of Mathematical Practices	1. Make sense of problems and persevere in solving them.	8. Look for and express regularity in repeated reasoning.

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			Final Presentation Activities	Outcomes/Products
Investigation 7		0.1	Formulate a formal Letter of Response. Final Acceptance Tests: Initial pitch (3 minutes) feedback	Journal and design brief. Final robot.
	2x	0.3	Final Acceptance Tests: Final pitch (3 minutes)	Final robot.

Engineering & Technology Standard	Science Correlations						Math Correlations			iste-nets				English Language Arts Correlations		
	Practices		Crosscutting Concepts		Core Ideas		Common Core	Practices		Student		Teacher		Reading	Writing	Speaking & Listening
MSENGR-TS-6	1	5	1	5	PS2.A	PS3.C	MCC8.SP.1	1	5	1	5	1	5	RST.8.7	WHST.8.2	SL.8.1
	2	6	2	6	PS2.B	ETS1.B		2	6	2	6	2		RST.8.8	WHST.8.4	SL.8.4
	3	7	3	7	PS2.C	ETS1.C		3	7	3		3				
	4	8	4	8	PS3.B			4	8	4		4				

Characteristics of Science			GPS Content Standards	
1	5	9	S8P2.b.	
2	6	10	S8P3.b.	
3	7		S8P3.c.	
4	8			

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